PAPERS AND ORIGINALS

Pain Threshold and Arthritis*

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British Medical Journal, 1972, 4, 193-195

Summary

Pain threshold was measured in 106 patients with rheumatoid arthritis, 50 with ankylosing spondylitis, and 50 normal controls using Keele's algometer. In rheumatoid arthritis patients with a low pain threshold had more severe pain for a greater part of the day and required more tablets for pain relief. In ankylosing spondylitis the pain threshold was higher and was not related to pain or analgesic requirements. There was no evidence that pain threshold affected the course or outcome of rheumatoid arthritis in any way.

Introduction

Pain threshold and its effect on arthritis has often been the object of opinion, sometimes of observation, but seldom of experiment. Pain is the major symptom of most types of arthritis and the major cause of disability, and relief of pain is the aim of most therapy. It is, therefore, surprising that pain threshold has received so little attention.

It is a common observation that the severity of pain varies from patient to patient. Some complain persistently and demand relief; others with apparently similar disease complain very little, require few analgesics, and continue their work, which may be quite unsuitable. Bywaters (1964) found cystic changes in x-ray examinations of the hands of patients with rheumatoid arthritis, particularly those with little pain, strong muscles, and heavy jobs who continued to work despite their arthritis. Castillo *et al.* (1965) showed that there was an inverse relation between the presence of radiological articular erosions and porosis. Heavy manual work was associated with larger erosions and less porosis, and Scott (1965) suggested that this might be related to pain threshold.

*Based on a paper read by E. C. Huskisson at a meeting of the Heberden Society and the Dutch Society of Rheumatologists, Nijmegen, 1972.

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Though a period of rest has a favourable effect on the symptoms of rheumatoid arthritis for a time, there is no clear evidence that a patient who gives up work and rests all day will ultimately be better off than another who continues to do heavy manual work. In favour of rest is the effect of denervation which protects against rheumatoid arthritis (Kamermann, 1966; Glick, 1967). On the other hand, Clark (1951) reported a patient with rheumatoid arthritis and congenital indifference to pain in whom the association appeared to be beneficial.

We set out to determine the effect of pain threshold on various aspects of rheumatoid arthritis. We chose also to study a group of patients with ankylosing spondylitis, who have a chronic painful disease but seem to suffer less. Hart (1955) noted, for example, that most patients under his care continued to work despite their disease.

Methods

Altogether, 106 hospital outpatients with rheumatoid arthritis, definite or classical by the American Rheumatism Association criteria, 50 with ankylosing spondylitis, and 50 normal controls were studied. The normals were volunteers and represented a cross-section of workers in a pharmaceutical company.

Pain threshold was measured by Keele's method (Keele, 1954). The algometer was slightly modified to increase the sensitivity of the scale, and a metronome was used to ensure that the force applied was increased at a constant rate. The end-point of the method was taken as the patient's verbal statement of pain, and the result was expressed in kg. A maximum of 5 kg was applied. Repeated measurements were made until three consecutive readings were within 0.5 kg; the modal value was then taken as the pain threshold. A routine was established in which measurement of pain threshold was made at the same time as other more familiar assessments and no discussion took place. All measurements were carried out by the same observer at the same time of day with only the subject present and using a standard "patter" to introduce the method.

In patients with rheumatoid arthritis and ankylosing spondylitis an assessment was also made of pain severity, duration of pain, duration of morning stiffness, analgesic requirements, work status, and the number of days lost from work in the previous year. Pain severity was measured on a simple scale graded as: severe (4), moderate (3), mild (2), or absent (1). The duration of pain was measured on a similar scale graded as: present for more than half of the day (4), about half of the day

(3), less than half of the day (2), and with only certain jobs or movement (1). Analgesic requirements were measured in two ways, firstly, as the total number of tablets of all types taken, and secondly, the number of analgesics not prescribed for regular use but to be taken on demand. These are referred to as "total tablets" and "analgesics on demand." Erythrocyte sedimentation rate was measured, and an assessment of functional capacity was made on the scale used in the Empire Rheumatism Council cortisone and aspirin trial (1955).

In patients with rheumatoid arthritis measurements were also made of articular index (Ritchie *et al.*, 1968), grip strength, and anatomical stage (Steinbrocker *et al.*, 1949). An assessment of the severity of involvement of weight-bearing joints (knees and hips) was made on a simple scale graded as: normal (pain-free, no swelling or tenderness) (1), mild (pain or swelling but no limitation of movement) (2), moderate (pain, restriction of movement, deformity or limp) (3), and severe (fixed, inadequate for weight-bearing or requiring surgery) (4). X-ray findings of the hands were graded according to the Council for International Organizations of Medical Sciences classification (1963); porosis and erosions were graded by the method of Castillo *et al.* (1965).

In patients with ankylosing spondylitis measurements were made of spinal range of movement using the spondylometer (Dunham, 1949). Anatomical stage was assessed on a three point scale graded as: patients with symptoms but no limitation of movement, stage 1; limitation of movement and radiographical changes in the spine, stage 2; kyphosis or peripheral joint deformities, stage 3.

Results

The distribution of pain threshold in the three groups is shown in Table I. Division into high, normal, and low is arbitrary but based upon the same limits as those used by Keele (1954).

TABLE I—Distribution of Pain Threshold in Patients with Rheumatoid Arthritis or Ankylosing Spondylitis and in Normal Controls

Pain Threshold (kg)	Normal Controls	Rheumatoid Arthritis	Ankylosing Spondylitis
Low (<2)	14.0%	17.0%	2.0%
Normal (2-4)	52.0%	57.5%	42.0%
High (>4)	34.0%	25.5%	56.0%

The distribution in normals is similar to that reported in a larger group by Keele (1954). The difference between the patients with rheumatoid arthritis and normals is not statistically significant ($\chi^2 = 1.3$, $P > 0.1$). The differences between ankylosing spondylitis and either rheumatoid arthritis or normals are statistically highly significant ($\chi^2 = 16.1$, $P < 0.01$) and significant ($\chi^2 = 7.7$, $P < 0.05$) respectively.

There were appreciable differences in many respects between the patients with rheumatoid arthritis and those with ankylosing spondylitis (Table II). In all three groups pain threshold increased with age, correlation coefficients in the patients with rheumatoid arthritis, ankylosing spondylitis, and normals being 0.14, 0.31, and 0.29 respectively. The mean age of the control

TABLE II—Some Differences in Rheumatoid Arthritis and Ankylosing Spondylitis. Figures are Mean Values

	Rheumatoid Arthritis	Ankylosing Spondylitis
Age	52	40
Sex, Male : Female	1 : 2.7	15.7 : 1
Pain severity grade	3.0	2.5
Total tablets taken	9.2	2.8
Analgesics "on demand"	4.2	0.8
Days lost by workers	105.2	52.6
Pain threshold grade	3.1	4.0

group (34 males and 16 females) was 34.5 years. There was no difference in mean pain threshold in normal males and females.

Pain Threshold and Pain.—There was a statistically highly significant relation between pain threshold and both pain severity and pain duration in patients with rheumatoid arthritis (Tables III and IV). In ankylosing spondylitis, there was no significant relation between pain threshold and either pain severity or duration.

TABLE III—Grade of Pain Threshold and Pain Severity in 106 Rheumatoid Arthritis Patients

Pain Severity	Pain Threshold	
	0-3	3-5
1-2	11	18
3	29	15
4	26	7

$$\chi^2 = 11.4, P < 0.01.$$

TABLE IV—Grade of Pain Threshold and Duration of Pain in 106 Rheumatoid Arthritis Patients

Pain Duration	Pain Threshold	
	0-3	3-5
1	12	18
2	7	9
3	16	6
4	31	6

$$\chi^2 = 17.1, P < 0.01.$$

Pain Threshold and Analgesics.—In patients with rheumatoid arthritis there was a statistically significant inverse correlation between pain threshold and the total number of tablets taken ($R = -0.21$, $P < 0.05$), and also between pain threshold and the number of analgesics taken on demand ($r = -0.25$, $P < 0.01$). In ankylosing spondylitis the number of tablets taken was much less and there was no significant correlation with pain threshold.

Pain Threshold and Disease Severity.—Two measures of disease severity in rheumatoid arthritis showed significant correlations with pain threshold: articular index ($r = -0.45$, $P < 0.001$) and grip strength ($r = 0.2$, $P < 0.05$). Other measures of disease activity, anatomical stage, functional class, duration of morning stiffness, erythrocyte sedimentation rate, involvement of weight-bearing joints, and radiographical changes showed no significant relation with pain threshold. In ankylosing spondylitis there were significant relations between pain threshold and anatomical stage and functional class but not duration of morning stiffness, erythrocyte sedimentation rate, or spondylometry. There was also a significant relation with duration of disease ($r = 0.32$, $P < 0.02$). Patients with more severe disease, of longer standing and greater functional impairment, tended to have higher pain thresholds (Table V).

TABLE V—Grade of Pain Threshold and Functional Class in 50 Ankylosing Spondylitis Patients

Functional Class	Pain Threshold		
	<3	3.5-4.5	5
1	14	7	9
>1	2	8	10

$$\chi^2 = 7.4, P < 0.05$$

The inadequacy of the methods used for measuring disease severity is indicated by the correlation coefficients of each measurement with another, which for rheumatoid arthritis varied from 0.11 to 0.71 and for ankylosing spondylitis from 0.02 to 0.63. In rheumatoid arthritis all criteria of disease severity showed significant correlations with pain severity, most with total tablet consumption and some with analgesic consumption. In ankylosing spondylitis some criteria of disease severity

correlated with pain severity, one with total tablet consumption and none with consumption of analgesics on demand.

TABLE VI—Mean Pain Threshold Grade and Articular Index in Patients who were eligible for Work

		Ankylosing Spondylitis	Rheumatoid Arthritis	
		Pain Threshold	Pain Threshold	Articular Index
At work, no days lost	..	3.9	3.4	9.7
At work, some loss of time	..	4.0	3.0	12.2
Unable to work	..	4.6	2.7	24.6

Pain Threshold and Employment.—Of patients eligible for work, 88% of those with ankylosing spondylitis were employed and pain threshold tended to be highest in those with more severe disease who were unable to work (Table VI). This was opposite to the trend in rheumatoid arthritis where the lowest mean pain threshold was found in patients unable to work. These differences were not statistically significant but there were striking differences in disease severity in these three groups, articular index showing a highly significant correlation with number of days lost from work ($r = 0.46$, $t = 4.4$, $P < 0.001$). Seventy-five per cent. of eligible patients with rheumatoid arthritis were employed. In the normal control group there was a highly significant inverse correlation between pain threshold and the number of days lost from work ($r = -0.66$, $P < 0.001$).

Radiographical Changes in Rheumatoid Arthritis.—There was an inverse relation between the degree of osteoporosis and the size of erosions ($\chi^2 = 15.8$, $P < 0.02$) but no relation between pain threshold and severity of radiographical changes (Council for International Organizations of Medical Sciences classification, 1963), the size of erosions, severity of porosis, or presence or absence of cysts.

Discussion

A large number of different methods have been used to measure pain threshold (Beecher, 1959). Keele's method has the advantage of simplicity and, being harmless, is readily applicable to patients. We found that the manner of conducting the experiment was of great importance. Beecher (1959) lists 26 types of factor which may influence pain threshold in man and we tried to keep these constant. We agree with Beecher's suggested use of "subjects who know nothing of the purpose of the experiment or the parameters at issue and who care nothing about the outcome." If a patient was allowed to recount tales of his war wounds or his chronic familiarity with pain a high pain threshold would certainly result. For this reason measurement of pain threshold was carried out at the same time as the routine measurements of rheumatoid arthritis and no discussion of the method or the purpose of the experiment was allowed. An atmosphere of competition also raises pain threshold and for this reason just the subject and the observer were present when the measurements were made.

By using the same method, Keele (1968) showed that after myocardial infarction patients with low pain threshold have more pain which lasted longer and required more analgesics. Our findings in rheumatoid arthritis are the same. We have also shown that pain severity, pain duration, and analgesic requirements are related to disease severity. There was some relation between pain threshold and days lost from work but disease severity appeared to be more important in this respect.

Two measurements of disease severity in rheumatoid arthritis, grip strength, and articular index showed a significant correlation with pain threshold. This emphasizes that these measurements, like pain, are not objective but depend on the subject and his pain threshold. None of the objective measures of disease severity correlated with pain threshold, and there was no evidence that pain threshold affected the course of the disease in any way. In particular, patients with higher pain thresholds showed no tendency to greater disability, more severe radiographical changes or involvement of weight-bearing joints. We confirmed the finding of Castillo *et al.* (1965) that there was an inverse correlation of porosis with the size of erosions but did not find a higher pain threshold in patients with larger erosions or cysts who might have been expected to be more active.

Though we made repeated measurements of pain thresholds in some patients we were not able to identify relapses of rheumatoid arthritis that were due to a fall in pain threshold. Pain threshold tended to remain constant for long periods of time and was unaffected by a period of inpatient treatment during which the arthritis improved. In a separate experiment we found that simple analgesics had no greater effect on pain threshold than placebo.

Striking differences were found between patients with rheumatoid arthritis and those with ankylosing spondylitis, and these are not explicable either by the younger age or male sex of the patients with ankylosing spondylitis. A possible explanation of the finding of a higher pain threshold in ankylosing spondylitis is the different attitude transmitted by the physician to the patient with this disease. They are encouraged to lead normal lives, remain mobile, and to take up rather than give up. The patient with rheumatoid arthritis is encouraged to rest and to protect his joints. In support of this hypothesis, de Haas *et al.* (1972) reported a series of cases of rheumatoid arthritis which he called "typus robustus." Despite active arthritis with unfavourable prognostic features such as nodules and high titres of rheumatoid arthritis they remain at work, have little pain, and do well. Though we have no evidence that our explanation for these findings is true, we have shown that a high pain threshold is not a disadvantage in rheumatoid arthritis, and therefore suggest that measures to raise pain threshold can safely form part of the treatment of the disease. These presumably include encouraging the patient to lead a life of maximum fulfilment.

References

- Beecher, H. K. (1959). *Measurement of Subjective Responses*. New York, Oxford University Press.
- Bywaters, E. G. L. (1964). In *Radiological Aspects of Rheumatoid Arthritis*, ed. M. E. Carter. International Congress Series No. 61. Amsterdam, Excerpta Medica Foundation.
- Castillo, B. A., El Sallab, R. A., and Scott, J. T. (1965). *Annals of the Rheumatic Diseases*, 24, 522.
- Clark, C. J. M. (1951). *Annals of the Rheumatic Diseases*, 10, 105.
- Council for International Organizations of Medical Sciences (1963). *Epidemiology of Chronic Rheumatism*, vol. 2. Oxford, Blackwell Scientific.
- Dunham, W. F. (1949). *British Journal of Physical Medicine*, 12, 126.
- Empire Rheumatism Council (1955). *Annals of the Rheumatic Diseases*, 14, 353.
- Glick, E. N. (1967). *British Medical Journal*, 3, 26.
- de Haas, W. H. D., de Boer, W., Griffioen, F., and Oosten-Elst, P. (1972). Paper presented at a combined meeting of the Heberden Society and the Dutch Society of Rheumatologists.
- Hart, F. D. (1955). *Annals of the Rheumatic Diseases*, 14, 77.
- Kamermann, J. S. (1966). *Annals of the Rheumatic Diseases*, 25, 361.
- Keele, K. D. (1954). *Lancet*, 1, 636.
- Keele, K. D. (1968). *British Medical Journal*, 1, 670.
- Ritchie, D. M., *et al.* (1968). *Quarterly Journal of Medicine*, 37, 393.
- Scott, J. T. (1965). *Annals of the Rheumatic Diseases*, 24, 526.
- Steinbrocker, O., Traeger, C. H., and Batterman, R. C. (1949). *Journal of the American Medical Association*, 140, 659.